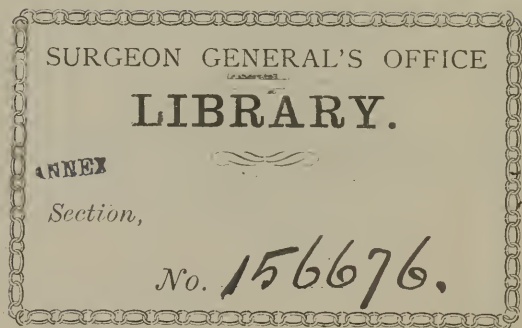


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Ophthalmic Operations

as

Practiced on Animals' Eyes.

By

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PREFACE.

THIS little work has been prepared in the hope that it may prove of assistance to those beginning the study of ophthalmology by enabling them to become acquainted with the technique of the various operative procedures through practice on animals' eyes, thus removing a certain amount of timidity and affording a larger experience and more confidence when attempting the operations on the human eye.

In so small a work where conciseness is one of the objects to be attained, it is impossible to describe all of the various methods of performing an operation, so that only those that have proved to be of the greatest service in the author's experience have been included. The general idea gained from the practice of the methods described will be sufficient to enable the student to practice any other methods desired.

Operations upon the lids have been omitted, as they can be best practiced upon the cadaver.

Messrs. E. B. Meyrowitz of New York City, and Charles Lentz & Sons, of Philadelphia, have very kindly furnished the cuts of instruments that have been used in illustrating the book.

47 North 17th St., Philadelphia.

October, 1896.

CONTENTS.

CHAPTER I.

GENERAL CONSIDERATIONS.

	PAGE.
Choice of eyes, - - - - -	9
Time of removal from animal, - - -	10
Preservation for operating purposes, - -	10
The operating mask, - - - - -	12
Home-made mask, - - - - -	13
Preparation and adjustment of eye in mask,	15
Attention to details, - - - - -	16

CHAPTER II.

OPERATIONS UPON THE CORNEA.

Removal of a foreign body, - - - -	18
Application of the cautery, - - -	19
Paracentesis of the anterior chamber, - -	21
Saemisch's section, - - - - -	23
Tatooing the cornea, - - - - -	25

CHAPTER III.

OPERATIONS UPON THE IRIS.

Iridectomy, - - - - -	27
Position of the coloboma, - - - -	28

	PAGE.
Position of the operator, - - - -	29
Instruments required, - - - -	30
Position of the corneal section, - - - -	30
Method of operating, - - - - -	32
Iridotomy, internal, - - - - -	37
Iridotomy, external, - - - - -	38
Iridodialysis, - - - - -	39
Iridavulsion, - - - - -	40

CHAPTER IV.

OPERATIONS UPON THE CRYSTALLINE LENS AND CAPSULE.

Ripening of immature cataracts, - - -	42
Discission of cataract, - - - -	43
Suction operation of cataract, - - -	45
Simple linear extraction of cataract, - -	46
Varieties of corneal sections, - - - -	48
Method of practicing the different sections,	51
Methods of opening the capsule, - - -	53
Extraction without capsulotomy, - - -	54
Position of the mask, - - - - -	54
Position of the operator, - - - - -	55
Method of operating, - - - - -	55
Accidents occurring during extraction of cata- ract, - - - - -	65
Extraction without iridectomy, - - -	68
Operations for secondary, or after-cataract, -	69

CHAPTER V.

OPERATIONS UPON THE SCLERA.

	PAGE.
Anterior sclerotomy, - - - - -	71
Posterior sclerotomy, - - . -	73

CHAPTER VI.

OPERATIONS UPON THE MUSCLES.

Complete tenotomy, - - - - -	76
Partial tenotomy, - - - - -	80
Complications, - - - - -	81
Advancement of the ocular muscles, - -	82
Shortening an ocular muscle, - - -	85
Enucleation of the eye-ball, - - -	88
Accidents occurring during enucleation, -	90
Evisceration of the eye-ball, - - -	91
Resection of the optic nerve, - - - -	93
Exenteration of the orbit, - - - -	94
INDEX, - - - - -	95

LIST OF ILLUSTRATIONS.

FIG.		PAGE.
1.	A pig's eye, - - - - -	9
2.	A sheep's eye, - - - - -	9
3.	A bullock's eye, - - - - -	10
4.	Vienna mask, - - - - -	11
5.	The eye clip, - - - - -	12
6.	Home-made mask, - - - - -	14
7.	The phantom face, - - - - -	15
8.	Spud, - - - - -	18
9.	Fixation forceps, - - - - -	18
10.	Cautery probe, - - - - -	20
11.	Universal handle, - - - - -	21
12.	Paracentesis needle, - - - - -	21
13.	Straight keratome, - - - - -	21
14.	Spatula and probe, - - - - -	23
15.	Graefe cataract knife, - - - - -	24
16.	Tattooing needles, - - - - -	25
17.	Tattooing needles, - - - - -	26
18.	Broad peripheral iridectomy, - - - - -	28
19.	Small iridectomy, ciliary border preserved, - - - - -	28
20.	Narrow iridectomy, - - - - -	28
21.	Iris scissors, - - - - -	31
22.	Iris forceps, - - - - -	31
23.	Iris hook, - - - - -	31
24.	Position of keratome in iridectomy, - - - - -	33
25.	Position of iris forceps and scissors in iridectomy, - - - - -	34

FIG.	PAGE.
26. DeWecker's iris scissors, - - - -	38
27. Lance needle, - - - -	43
28. Knife needle, - - - -	43
29. Discission of soft cataract, - - -	44
30. Bowman's suction syringe, - - -	45
31. Cystotome and curette, - - -	46
32. Peripheral linear section, - - -	49
33. Beer's knife, - - - -	51
34. Eye in towel, - - - -	52
35. Methods of opening the capsule, - -	53
36. Knapp's cystotome, - - - -	54
37. Wire loop, - - - -	57
38. Capsule forceps, - - - -	56
39. Cataract knife making corneal section,	58
40. Cystotome opening the capsule, - -	61
41. Delivery of the lens, - - - -	63
42. Bowman's stop discission needle, - -	70
43. Anterior sclerotomy, - - - -	72
44. Lid speculum, - - - -	77
45. Conjunctival forceps, - - - -	77
46. Tenotomy scissors, - - - -	77
47. Strabismus hook, - - - -	77
48. Tenotomy of an ocular muscle, - -	78
49. Stevens' tenotomy scissors, - - -	81
50. Needle holder, - - - -	83
51. Advancement of an ocular muscle, -	84
52. Enucleation scissors, - - - -	88
53. Enucleation of an eye-ball, - - -	89
54. Evisceration scoop, - - - -	91
55. Mules' vitreous spheres, - - - -	92
56. Artificial vitreous introducer, - - -	93

CHAPTER I.

GENERAL CONSIDERATIONS.

Choice of Eyes.—For use in practicing the various operations, the pig's eyes seem to be the best. Bullock's eyes, while showing the relations on a much larger scale than the eyes of the pig, are too large for the instruments employed on the human eye, and are, therefore, not to be preferred. Sheep's eyes are slightly larger than the eyes of the pig and do not fit the regular masks so well. The pig's eyes are readily obtained, as a rule, and



Fig. 1. A Pig's Eye.

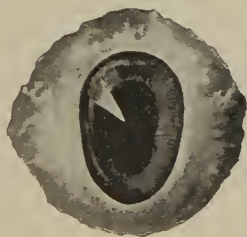


Fig. 2. A Sheep's Eye.

answer all purposes. The different eyes are seen in figs. 1, 2 and 3.

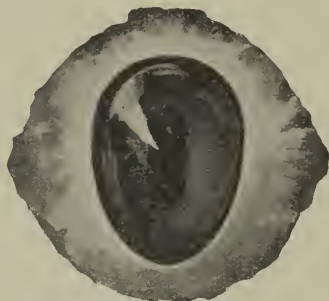


Fig. 3. A Bullock's Eye.

Time of Removal from Animal.—The eyes should be removed from the animal as soon as it has been killed and before they have had time to undergo any change, and especially before the animal has been scalded, preparatory to removing the bristles. The latter, if it takes place, spoils the eyes, making the corneæ hazy, and in some cases collapsed, so that they cannot be used for any satisfactory work.

Preservation for Operating Purposes.—If it is not desired to make use of the eyes on the day of their removal from the animals, they can be preserved



Fig. 4. Vienna Mask.

in a $\frac{1}{10}$ of a 1 per cent. solution of formaldehyde and will be good for operating purposes for one week. A stronger solution than this makes them too hard for operative work.

The Operating Mask.—There are many operating masks on the market, the best being the one shown in Fig. 4, known as the Vienna mask. It is made of hard rubber so that none of the various contents of the eyes are absorbed, and represents a human face with all the relations of the nose, temple and orbit preserved. In the orbital cavity is fastened a clipping arrangement (Fig. 5), easily removed, for

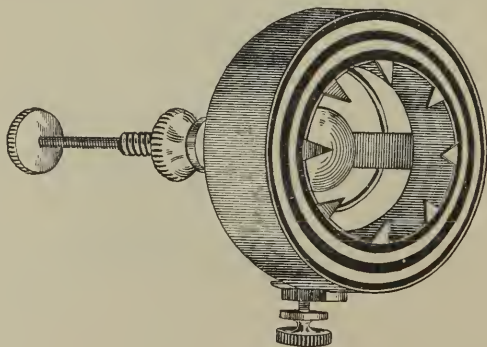


Fig. 5. The Eye Clip.

holding the eye in position. The eye can be held tightly or loosely, according to whether the long screw is tightened or loosened and is fastened in front by a circular band with teeth. The mask can be lowered to any degree desired from the vertical to the horizontal position, thus simulating the various positions that we are sometimes obliged to operate in. With an eye in each orbital cavity of this mask, the nearest approach to the relations existing in the human patient is to be obtained.

Home Made Mask.—It is not absolutely necessary to have a factory made mask, such as the above, in order to practice the various operations, for one that will answer the purpose, though to be sure somewhat crude, may be made by gluing a square piece of cork about one-half inch thick on the lid of a cigar box.

The eye can be fastened on this piece of cork with four tacks as shown in Fig. 6. The lid of the box can be lowered or



Fig. 6. Home-made Mask.

raised at pleasure, giving the desired angle for operation. While the Vienna mask is by far the more satisfactory, most excellent work can be accomplished on the one that can be easily made at home. There

are other masks on the market, made of *papier-mache*, and known to the trade as phantom faces, one of which is shown in Fig. 7.

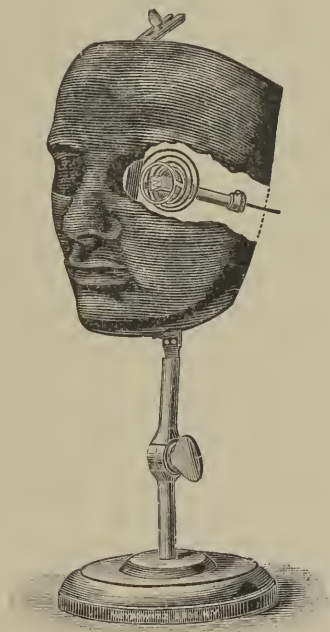


Fig. 7. The Phantom Face.

Preparation and Adjustment of Eye in Mask.—In placing the pig's eye in the clip for operation it is best to place the round end of the cornea so that it will

come directly upward in as much as one diameter is considerably longer than the other. By placing them in this manner the shorter diameter is horizontal, and the iris is not so apt to fall in front of the knife when making corneal sections.

If the muscles and conjunctiva have been left on the eyes after their removal from the pigs they must be partially (but not entirely) dissected off. It is always better to have a small amount attached, as the eye seems to hold better in the clip.

The eye having been prepared, it is placed in the holder in the position just described, the circular clip is pushed down over it to hold it in place and the holder is fastened into the orbital cavity of the mask by a small screw, when the eye is ready for operation.

Attention to Details.—In practicing any of the operations hereafter described as much attention must be paid to the most minute details as would be done were the operation being performed on

the human eye. Habits formed while practicing with the animal's eyes will adhere to one in later work, so that the greatest care should be taken that these habits be of the proper kind. As an example, it is only necessary to mention that many of the operations can be performed without holding the eye with the fixation forceps; but if the fixation forceps are called for, and the operation be practiced without their use, how awkward it is when the operation is attempted on the human eye where they cannot be dispensed with. So with the position of the operator; only those positions should be selected that are the proper ones for the human patient. The instruments required in any operation should be arranged in the order they will be needed before the operator begins; and, if he be assisted, he should not remove his eyes from the eye being operated upon until the operation is finished, the assistant placing in his hands, in their proper order, the instruments as required.

CHAPTER II.

OPERATIONS UPON THE CORNEA.

Removal of a Foreign Body.—For practicing the operation for the removal of a foreign body from the cornea, if there be no eye among the ones on hand in which this condition obtains, it may easily be produced by pressing a small piece of almost any foreign substance into the corneal tissue.

The instruments required are a spud (Fig. 8) and occasionally a pair of fixation forceps (Fig. 9) with which to hold the

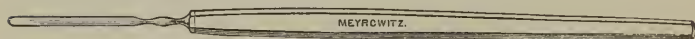


Fig. 8. Spud.



Fig. 9. Fixation Forceps.

eyeball if it be not firmly fixed in the holder. The eyeball being siezed with the forceps, if at all loose, the foreign body is picked out of the corneal substance with a quick movement, care being taken to get it out with as few picks as possible so as to produce little injury to the corneal epithelium. Should the foreign body, however, have pierced the posterior surface of the cornea, still remaining in the corneal tissue, it may be necessary first to introduce a keratome into the anterior chamber, preferably from the corneal margin nearest the foreign body, and use it as a support to the foreign body from behind while it is being extracted; otherwise there is danger of injury to the crystalline lens.

Application of the Cautery.—This operation is mostly performed in cases where infection of the cornea is rapidly spreading and it is desired to stop the progress as quickly as possible. For the purpose, either the galvanic or the actual

cautery may be employed. There are many elaborate outfits that have been designed for this use, but all that is actually required is an alcohol lamp and a small probe (Fig. 10), preferably of platinum. An ulcer of the cornea may be simulated by scraping away a portion of the corneal epithelium. The probe being placed in what is known as the universal handle (Fig. 11) which will protect the hand from the heat, if it is not attached to a handle of its own, the end is brought to a red heat in the flame of the alcohol lamp. The eye is seized with the fixation forceps and firmly held while the heated probe is gently brought in contact with the edges of the ulcer, the floor being included also if the ulcer



Fig. 10.
Cautery Probe

is not very large, great care



Fig. 11. Universal Handle.

being taken not to cauterize any of the surrounding healthy tissue.

Paracentesis of the Anterior Chamber.—The instruments required for the performance of this operation are a paracentesis needle (Fig. 12), which con-



Fig. 12. Paracentesis Needle.

sists of a trowel-shaped blade with a stop shoulder at one end and a small probe at the other, and a pair of fixation forceps (Fig. 8). In case the former instrument be not at hand a small keratome (Fig. 13) may be employed instead.



Fig. 13. Straight Keratome.

The point at which the instrument should enter the anterior chamber de-

pend upon the cause demanding the operation. If the paracentesis be performed to anticipate the threatened perforation of a corneal ulcer, the puncture should be made through the floor of the ulcer, but if it be for the relief of intra-ocular tension, as in glaucoma, when the corneal tissue is intact, the puncture should be made near the lower margin and preferably in the lower outer quadrant of the cornea.

The operation is performed in the following manner:

The eye is screwed very tightly in the mask so as to produce an artificial increase of intra-ocular tension, and then held firmly with the fixation forceps while the trowel-shaped knife is gently thrust through the cornea into the anterior chamber as far as the shoulder. The knife is usually entered at an angle of 45 degrees to that point of the cornea where the puncture is to be made, and as soon as it enters the anterior chamber the handle is depressed and the blade pushed forward,

care being taken not to injure the lens behind or the cornea in front. By slightly depressing or rotating the blade the lips of the wound are opened and the aqueous humor permitted to escape. This should be made to occur gradually and not with a rush, otherwise the sudden withdrawal of intra-ocular tension may cause injury to the lens or prolapse of the iris. Should the latter occur the iris is immediately replaced with the small probe or with a spatula (Fig. 14).

If it is necessary to reopen the anterior chamber again on the following day, it may be done by inserting the small probe end of the instrument into the wound previously made.

Saemisch's Section.—This operation is performed in those cases in which there exists a



Fig. 14.
Spatula and
Probe.

large sloughing ulcer of the cornea which is rapidly progressing, the corneal tissue itself being infiltrated with pus and accompanied by the condition known as hypopyon.

The instruments required are a Graefe cataract knife (Fig. 15) and a pair of fixa-

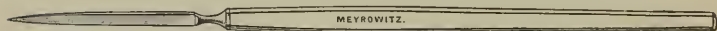


Fig. 15. Cataract Knife.

tion forceps. A large ulcer is simulated by scraping away a portion of the corneal epithelium, the eyeball is seized with the fixation forceps and the knife passed directly into the anterior chamber about 1 millimetre beyond the outer edge of the ulcer, that is, in the healthy tissue, with its cutting edge turned forward. The point of counter puncture is now made about 1 millimetre beyond the edge of the ulcer on the opposite side and the cornea cut through. This gives a horizontal incision through the floor of the ulcer which will evacuate the pus from the layers of

the cornea. If there be any thickened pus in the anterior chamber it is now seized with a pair of iris forceps and withdrawn. Should it be desired to open the wound on the following day it is done, as in paracentesis of the anterior chamber, with a small probe.

Tattooing the Cornea.—This operation is most frequently done for cosmetic purposes. Where there is a dense white leucoma of one eye in, or near, the center of the cornea, it can be tattooed so as to resemble, at a short distance, the black pupil of the opposite eye, thus rendering the appearance of the patient more agreeable.

For the purpose we employ a bunch of small needles of exactly the same length (Fig. 16), or a small grooved needle, or a

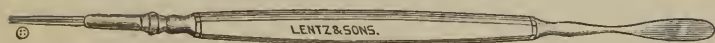


Fig. 16. Tattooing Needles.

bunch of needles tapered obliquely at the ends, as in Fig. 17.



Fig. 17. Tatooing Needles.

It is impossible to get a good effect of tattooing on an animal's eye in which the cornea is perfectly clear, but the operation may be practiced in the following manner: Having first prepared some India ink by rubbing it into a thin paste, the eye is steadied by means of the fixation forceps and a small amount of the paste placed on that part of the cornea to be tattooed. Then by making frequent pricks obliquely into the corneal substance with the needle the ink is made to penetrate it, thus forming a dense black spot. By extending the pricks in different directions the pupil, or the tattooed spot, can be made as large as desired. The idea of employing pigments of various colors outside of the black spot just made in order to reproduce the colors of the iris has been suggested.

CHAPTER III.

OPERATIONS UPON THE IRIS.

Iridectomy.—The operation of iridectomy is performed for many purposes, among which are the relief of intra-ocular tension, the improvement of vision (as, for example, when there is a large central leucoma), for recurrent iritis, for partial staphylomata, for foreign bodies embedded in the iris and as a preliminary to the operation for the extraction of cataract. Before performing the operation there are several things to be considered.

It is usual to speak of three kinds of iridectomy which practically means three sizes of colobomata made in the iris. The difference is well shown in Figs. 18, 19 and 20. Figure 18 shows a broad peripheral iridectomy such as is performed for

the relief of intra-ocular tension. Figure 19 shows a small iridectomy in which only a small piece from the pupillary margin has been excised, leaving the peripheral fibres of the iris intact. Figure 20 shows the iridectomy performed as a preliminary to cataract extraction, etc.

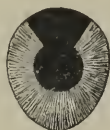


Fig. 18.

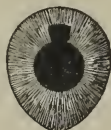


Fig. 19.



Fig. 20.

Fig. 18. Broad peripheral iridectomy. Fig. 19. Small iridectomy, with ciliary border preserved. Fig. 20. Narrow iridectomy for optical purposes. (Modified, after Swanzy).

The width of the coloboma depends greatly upon the length of the corneal incision; the depth upon the position of the incision, the farther behind the corneo-scleral junction the knife is entered the greater the depth.

Position of the Coloboma.—If the iridectomy be for the relief of intra-ocular tension, or as a preliminary to the extrac-

tion of a cataractous lens, there being no contra-indication, the coloboma is made directly upward so that a portion of it may be covered by the upper lid, thus preventing, as much as possible, the disagreeable dazzling that is frequently caused by too much light entering the eye. If the operation be for optical purposes the best position, if other conditions will permit, is inward, or downward and inward. For the restoration of a pupil bound down by synechiæ it is better to excise that portion of the iris that seems to be the least attached.

The operator may stand either behind or by the side of the mask. If the former position is chosen and the keratome is being used, he pushes the knife from him. If the latter position is preferred he pushes the knife towards himself. If the Graefe knife be employed, however, the conditions are somewhat changed.

Position of the Operator.—With this, should the operator be ambidextrous,

he may stand either behind or beside the patient as he chooses, but if he has not reached this state of perfection it is better to stand behind the patient when operating on the right eye and on the left side when operating on the left eye, provided he uses his right hand.

Instruments Required.—The instruments necessary for practicing the operation of iridectomy on pig's eyes are a pair of fixation forceps (Fig. 9), a keratome (Fig. 13), or a Graefe cataract knife (Fig. 15), a pair of curved iris scissors (Fig. 21), a pair of curved iris forceps (Fig. 22), an iris hook (Fig. 23), and a spatula (Fig. 14).

Position of the Corneal Section.—If a broad peripheral iridectomy be desired the keratome, or the Graefe knife, should be entered about 1 to $1\frac{1}{2}$ millimetres back of the apparent corneo-scleral junction; but if a narrow iridectomy be what is required, the point of entrance should be at the apparent corneo-scleral junction.



Fig. 9. Fixation forceps.



Fig. 14. Spatula.



Fig. 13. Keratome.

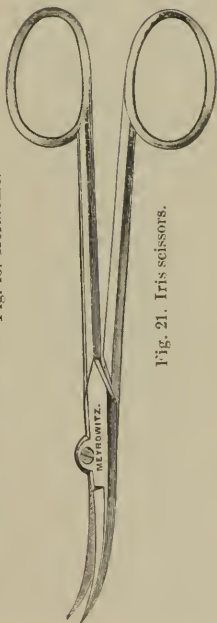


Fig. 21. Iris scissors.

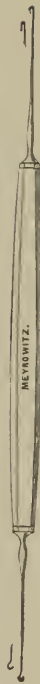


Fig. 23. Iris hook.



Fig. 22. Iris forceps.

Instruments Required in Iridectomy.

Method of Operating.—In the performance of an iridectomy we can divide the operation into three stages. First, making the corneal section; second, excision of the iris; third, the toilet of the wound.

The mask containing the eye should be flat if the operator stands behind it, or at an angle of about 30 degrees if he stands in front of it.

(I). *The Corneal Section.*—The eye is firmly seized with the fixation forceps at a point opposite to the proposed section and the keratome is entered at, or behind the corneo-scleral junction according to the effect desired from the operation (Fig. 24). The point of the keratome is passed through the cornea at right angles but as soon as it enters the anterior chamber the handle is depressed and the knife pushed forward on a plane parallel to the iris, care being taken to avoid wounding the cornea, iris, or the capsule of the lens. As soon as the desired depth is reached,

that is as soon as the section becomes sufficiently wide to permit as large a



Fig. 24. Position of the keratome in iridectomy.

coloboma to be made as is required, the instrument is carefully withdrawn, the aqueous humor being allowed to escape very gradually to prevent any complication from a sudden lowering of the tension of the globe.

(2). *Excision of the Iris.*—The fixation forceps are now passed to an assistant

who rotates the eye-ball downward (if the iridectomy be an upward one), care being exercised that the movement made is one that rotates the eye and not a dragging, or a pulling movement.

The iris forceps held in the left hand are now passed into the anterior chamber as far as the pupillary margin of the iris, which is seized and slowly withdrawn and cut off with one or two snips of the iris scissors held in the right hand (Fig. 25). In entering the iris forceps, the

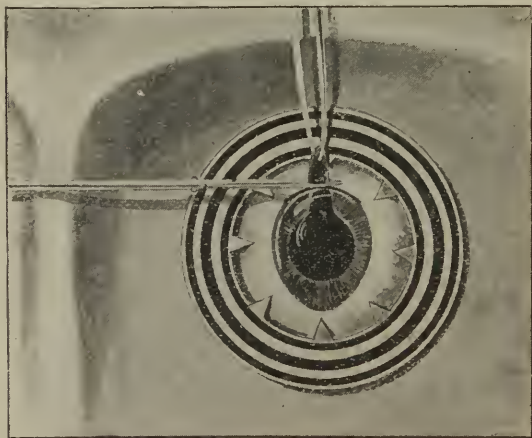


Fig. 25. Position of iris forceps and scissors in iridectomy.

blades are kept closed until the pupillary margin is reached, when they are opened, and the handle being dipped slightly downward throws the small teeth of the forceps into the iris tissue, so that it is easily held and withdrawn from the anterior chamber. If a small coloboma is desired only a small piece of the iris is excised and it can be done with one snip of the scissors. If a large coloboma is needed the scissors should press the cornea away from the iris as much as possible, when the latter can be cut off with two snips. Should an extra large coloboma be required, after cutting one side of the iris the remaining portion of the latter is dragged as far as possible to the opposite side before the second snip is made.

(3). *Toilet of the Wound*.—If the pillars of the coloboma are now in their proper positions in the anterior chamber, the lips of the wound are cleansed and placed in apposition by passing a small spatula be-

tween them. Should any portion of the iris be caught in the wound, however, it must be freed and replaced in its proper position.

If an iridectomy is required in an eye in which the anterior chamber is exceedingly shallow it is, perhaps, better to make the corneal section with a Graefe knife. Indeed this is the custom of some surgeons in all cases.

Iridotomy.—This operation is for the formation of an artificial pupil and is usually performed in cases where the lens is absent and the pupil closed as a result of inflammatory changes, such, for example, as sometimes occurs when an iridocyclitis follows the operation for cataract. It may, however, be also performed on eyes where the lens is still present. The object of the operation is to make a slit in the iris in such a manner that the contraction of the fibres of this membrane on either side of the slit will make an opening (artificial pupil) through which the

patient can exercise the visual functions.

The operation may be performed according to the method of de Wecker, which is employed when the lens is absent, and is as follows :

Internal Iridotomy. (*Method of de Wecker*.—Holding the eye-ball firmly with the fixation forceps a keratome is passed through the cornea at the corneo-scleral margin nearest to that portion of the iris in which the opening is to be made, the corneal section being about 5 millimetres wide. The point of the keratome is either passed to the opposite side of the anterior chamber until the section is of the required width as in the section for iridectomy, or the point is dipped backward and made to pass through the iris tissue itself in the part that is to be further operated upon. A pair of de Wecker's scissors (Fig. 26) with the blades closed, are now passed into the anterior chamber, the blades opened, and one thrust through the iris,

if the opening has not been made with the keratome, or through the opening if such has been made, pushed downward to the required depth and again closed, severing the sphincter and making a slit like opening in the iris which enlarges by the contraction of the fibres on both sides. As is readily seen there is almost always some loss of vitreous following this operation, and it is only applicable to cases in which the lens is absent.

In cases in which the lens is present a somewhat different method has been employed.

External Iridotomy. (Method of La Grange).—A section is

made in the cornea according to the directions given in the preceding paragraph except that the entrance of the keratome should be within the clear cornea if possible, instead



Fig. 26.

De Wecker's
iris scissors.

of at the corneo-scleral junction and must be large enough to permit the iris to be withdrawn should it not prolapse spontaneously. If the iris does not now prolapse it is to be gently withdrawn with the iris forceps, and with the scissors, one blade in front and one behind, a slit is made of the required length in that portion of the sphincter that seems to possess the greatest tension. The iris is now carefully replaced into the anterior chamber by means of the small spatula (Fig. 14). (In the human eye a few drops of a solution of eserine are instilled before and after operation).

Irido-dialysis.—Irido-dialysis is an operation seldom performed at the present time, but which was formerly employed in those cases in which only the extreme margin of the cornea was available for optical purposes. It consists in tearing away from its periphery a portion of the iris situated behind the clear margin of the cornea. The operation may be

practiced with a keratome (Fig. 13) and an iris hook (Fig. 23). A small opening is made in the cornea by means of the keratome, if possible opposite to the portion of the iris to be torn away from its periphery. If this portion of the cornea cannot be employed for the section, the next best is selected that will permit the following step of the operation to be executed: A small hook is introduced into the anterior chamber through the corneal opening and passed to the periphery of the iris, when by gentle traction it is torn away. The ciliary bodies and the lens are so apt to be injured by this operation that it has been almost entirely superseded by a small peripheral iridectomy.

Iridavulsion.—This operation differs from the preceding one in that the whole iris, instead of a small portion, is torn away from its periphery. It has been recommended in certain cases, not for the restoration of vision, but for the improvement of the health of the eye by “restor-

ing free communication between the anterior and posterior chambers, and by unclosing the lymph channels and vessels at the margin of the anterior chamber " (Noyes).

CHAPTER IV.

OPERATIONS UPON THE CRYSTALLINE LENS AND CAPSULE.

Ripening of Immature Cataracts.

—There are two methods most frequently employed for the ripening of immature cataracts, viz., the one suggested by Förster and the one suggested by Bettman. In each a narrow iridectomy should first be performed. In Förster's method massage of the lens substance is then obtained by gently rubbing a small spatula over the cornea as it lies in contact with the lens capsule. In Bettman's method the spatula is introduced into the anterior chamber and massage performed directly on the capsule of the lens. In the first method care must be exercised to avoid denuding the corneal epithelium, and in either method to avoid injury to the iris.

METHODS OF OPERATING UPON SOFT CATARACTS.

Discission of Cataract.—The operation of discission is performed in cases of soft cataract where it is desired to get rid of the cataractous lens by absorption. An opening is made in the capsule of the lens, thus permitting the entrance of the aqueous humor which produces dissolution of the lens substance and is followed by absorption.

The instruments required are a discission needle, either a lance (Fig. 27), or a knife needle (Fig. 28), and fixation forceps.



Fig. 27. Lance needle.



Fig. 28. Knife needle.

The eye being fixed with the forceps, a needle is entered perpendicularly into the anterior chamber about the centre of the lower and outer quadrant of the cornea,

and the handle being lowered it is pushed as far forward as the anterior capsule of the lens. Then by using the cornea as a fulcrum and elevating the handle of the



Fig. 29. Discission of soft cataract.

needle, a transverse cut is made in the capsule. A second cut, if required, may be made at right angles to the first.

Should the lens capsule be especially thick, or should there be a small amount of lens substance remaining, a second



Fig. 30. Bowman's suction syringe.

needle may be entered at a corresponding point on the nasal side of the cornea, in which case the two needles are pushed towards the centre of the capsule, and by approximating the handles a tear or incision is made (see Fig. 29).

Suction Operation of Cataract.—This method of operating, like the preceding, is also employed only in cases of soft cataract. The operation is performed as follows:

A discission needle is first introduced in the manner described in the operation of discission, and a large opening made in the capsule. An incision in the cornea is now made with a keratome, preferably in the outer half midway between the centre and the periphery. The point of a Bowman's (Fig. 30), or a Teale's, syringe, is now

passed through the corneal and capsular openings into the lens, and gentle suction employed which will cause the lens substance to be withdrawn.

Extraction of Cataract.—

Another method of removing a soft cataract is that known as the simple linear extraction. The instruments required are the fixation forceps (Fig. 9), a small keratome (Fig. 13), a cystotome and a curette (Fig. 31).

Fig. 31. Cystotome and Curette.



The eye being held with the fixation forceps at a point diametrically opposite to the proposed point of entrance of the keratome, the latter is passed into the anterior chamber at right angles to the cornea on the temporal side at a point corresponding to the apparent edge of the fully dilated pupil. The point of the keratome is thrust into the lens so as to open the capsule freely, and

in withdrawing the instrument the posterior lip of the wound is depressed while slight counter-pressure is made upon the opposite side with the fixation forceps, thus forcing the soft lens matter out.

Instead of opening the lens capsule with the point of the keratome, it may be done with the cystotome. In this case the posterior lip of the wound should be depressed with the curette or a small spatula, while counter-pressure causes the evacuation of the lens substance. Some operators also make a practice of performing a small iridectomy after making the corneal section. If it is the intention of the operator to pursue the latter course the section should be made just within the clear margin of the cornea.

OPERATIONS FOR HARD CATARACT.

In operating for hard cataract the principal steps are the making of a corneal section at, or in the neighborhood of, the corneo-scleral margin ; in some cases, the

removal of a piece of the iris; the opening of the lens capsule and the deliverance of the lens through the pathway made by these various openings. The principal difference between the operations now employed is the manner of making the corneal incision and whether or not iridectomy is employed.

Varieties of Section.—So many varieties of section have been suggested by different surgeons since the operation for the extraction of cataract began to be performed that there remains scarcely any portion of the cornea that has not, at some time or other, been the site of a proposed section.

(a) *Peripheral Linear Section.*—The section made by von Graefe, and from which so many of the others have been modified, consisted of entering the knife at a point $1\frac{1}{2}$ millimetres behind the apparent corneo-scleral junction in the upper and outer part of the eye and about 2 millimetres below a tangent to the up-

permost part of the cornea. The knife was then thrust downward and inward, parallel to the plane of the iris, until it reached the pupillary margin, when by lowering the handle the point was made to counter-puncture the sclera at a point opposite, and corresponding to, the point of entrance. The edge of the knife then being turned slightly forward, with a few sawing movements, the section was completed in the corneo-scleral margin. As soon as the sclera was completely cut through, and before the conjunctiva was divided, the edge of the knife was turned forward even more to avoid making a large conjunctival flap (Fig. 32).



Fig. 32. Peripheral linear section.

(b) *Section in Combined Extraction.* (*Three millimetre flap*).—In making the section known as the three millimetre flap, the point of the knife is entered

exactly at the apparent corneo-scleral junction on the temporal side of the cornea, at a point three millimetres below a tangent to the uppermost portion of the cornea, passed directly across the anterior chamber, and a counter-puncture made diametrically opposite the point of entrance. With a to and fro movement of the knife upward, keeping exactly in the same plane as the puncture and counter-puncture, the cornea is separated from the sclera exactly at the junction of the two. This section will give a very small conjunctival flap. Should a larger one be desired it can be made by tilting the edge of the knife slightly backward just before the conjunctiva is cut. The section just described is employed in extraction with iridectomy, or what is known as the *combined method*.

(c) *Section in Simple Extraction.* (*Upper half of cornea*).—This is the section usually employed in performing the extraction of cataract by the *simple method*,

or the method without iridectomy. The point of entrance into, and exit from, the anterior chamber is made just within the clear margin of the cornea, and the section includes about the upper or lower half of the circumference of the cornea, depending on the size of the lens and cornea, (in this country usually the former), the knife being kept in the same plane while the section is being made. By some surgeons the section is made with a Beer's knife (Fig. 33), or a modification, but the majority use the knife of von Graefe.

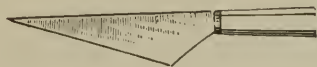


Fig. 33. Beer's knife.

For Practicing the Different Sections an eye may be held in the hand by means of a towel or napkin, as shown in (Fig. 34), the latter being wrapt around it in such a way as not to interfere with the knife. It is well to practice puncture and counter-puncture of the eye, and mak-

ing the different sections by holding some

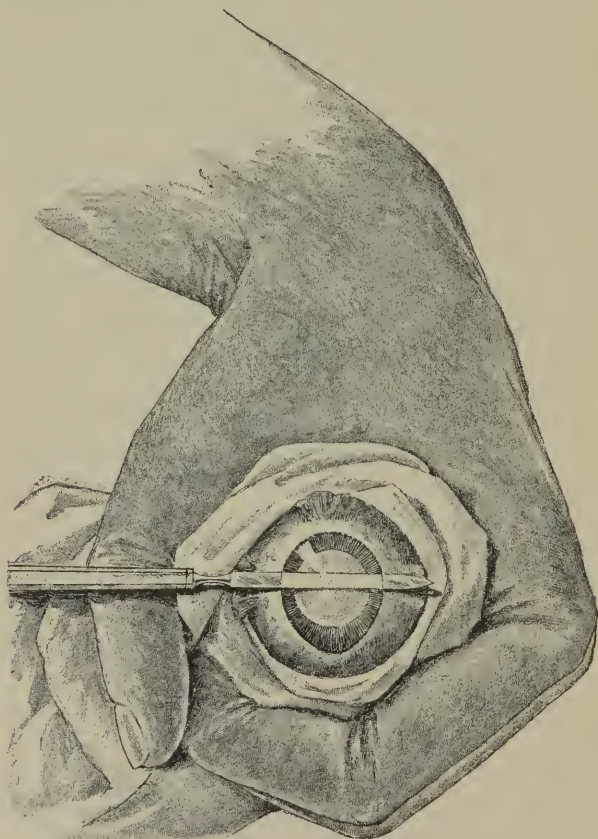


Fig. 34. Eye in towel.

eyes in this manner before attempting the operations for extraction of cataract; for

in this way the student can become acquainted with the appearance of the point of the knife when covered by aqueous humor, so that the counter-puncture can be made in the proper place and the section completed in the proper plane.

Methods of Opening the Capsule.

—As to the manner in which the lens capsule should be opened there is some difference of opinion. Some surgeons employ for the purpose a cystotome (Fig. 31), which is in reality a small triangular-shaped knife, while others use a capsule forceps devised especially for the purpose. If the cystotome be used one of the openings illustrated in Fig. 35 should be



Fig. 35. Methods of Opening Capsule.

made; or, if the operator prefers, the extreme peripheral opening as recommended

by Doctor Knapp may be made with a cystotome devised by the author of the method (Fig. 36).

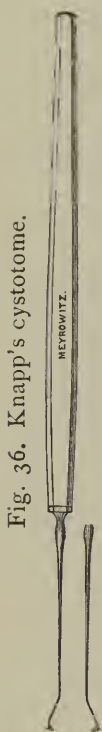


Fig. 36. Knapp's cystotome.

If the capsule forceps be employed they are made to seize as much of the capsule as possible, which is then drawn out and excised with the scissors. In either method, injury to the iris must be studiously avoided as well as the accidental dislocation of the lens.

Extraction without Capsulotomy.—Some surgeons instead of opening the capsule before the delivery of the lens, by a special instrument, deliver the lens and capsule together without opening the latter. By this method there is always great danger of serious loss of vitreous.

Position of the Mask.—The mask should be so placed as to resemble the position of a patient lying in bed, or in an

operating chair. For this purpose it should be perfectly flat during some operations and inclined at an angle during others. It is best to practice the operations at the different angles of inclination of the mask so as to become accustomed to the varying positions.

Position of the Operator.—If the operator be ambidextrous he may stand behind, or on either side of the mask as he chooses. If he is not ambidextrous, however, and employs his right hand to use the cutting instruments, he will stand behind the mask to operate on the right eye and on the left side of it to operate on the left eye. It is best to practice with each hand so as to become ambidextrous.

Method of Operating.—The following description of the combined extraction, or the extraction with iridectomy, applies to the method known as de Wecker's three millimetre flap extraction.

The instruments required are fixation forceps (Fig. 9), a Graefe cataract knife

(Fig. 15), iris forceps (Fig. 22), iris scissors (Fig. 21), a cystotome and curette (Fig. 31,) and a spatula (Fig. 14). In addiiton, it is well to have a wire loop (Fig. 37) and a capsule forceps (Fig. 38).



Fig. 38. Capsule forceps.

The operation is divided into five stages consisting of the following procedures. First, making the corneal section; second, the iridectomy; third, the capsulotomy; fourth, the delivery of the lens; fifth, the toilet of the wound.

The Corneal Section.—With the fixation forceps in one hand, the eye is seized below the cornea and rotated downward while in the other is lightly held the cataract knife at some distance from the blade so that the full length of the latter can be employed. The point of the knife is now entered on the outer side of the eye, ex-

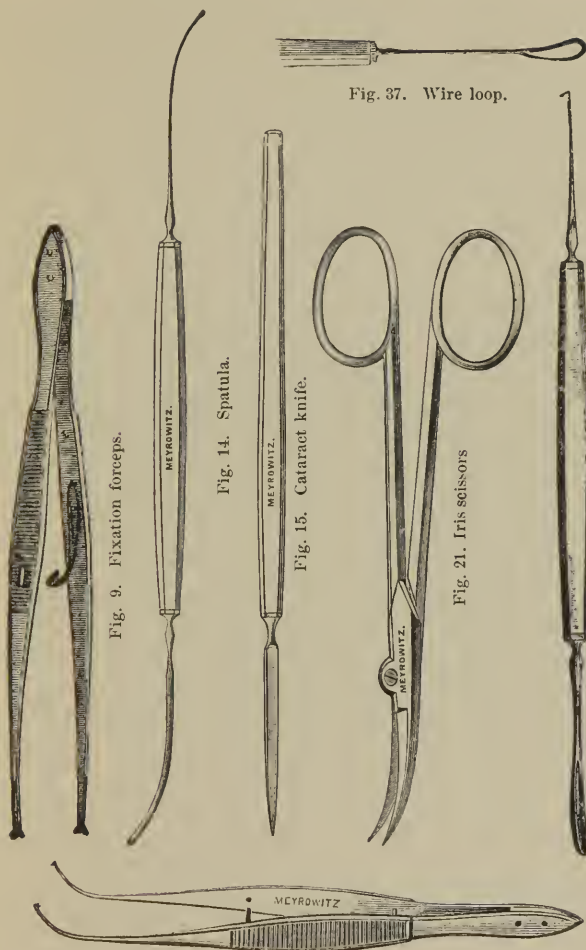


Fig. 37. Wire loop.

Fig. 9. Fixation forceps.

Fig. 14. Spatula.

Fig. 15. Cataract knife.

Fig. 21. Iris scissors

Fig. 31. Cystotome and Curette.

Fig. 22. Iris forceps.

Instruments Required in Extraction of Cataract.

actly at the apparent corneo-scleral junction, and at a point 3 millimetres below a tangent to the uppermost portion of the cornea. The knife may be entered perpendicular to the cornea, or it may be entered in the direction of the counter-



Fig. 39. Cataract knife making section.

puncture, in the latter case care being taken to avoid passing it between the corneal layers. After the point has entered the anterior chamber it is thrust carefully across and brought out at a point diamet-

rically opposite the point of entrance. The blade is pushed forward as far as the heel, or until the point almost touches the nose, when by a few to and fro sweeps, making the edge cut in both directions, and keeping in the same plane, parallel to the iris, in which the knife is entered, the upper portion of the cornea and sclera are divided exactly at their junction Fig. 39.

If the section be made as above there will result a small conjunctival flap. Should it be desired to make a larger one, or to avoid the conjunctiva altogether, the edge of the knife is turned slightly backward, or forward, as soon as the cornea and sclera have been divided, and before the conjunctiva is cut.

The Iridectomy.—The fixation forceps are now handed to an assistant who rotates¹ the eye downward, when the iris

¹ Frequently in animals' eyes it is impossible to rotate the eye downward without dragging it out of the mask, especially after the aqueous humor has escaped. In these cases the forceps will hold one of the small teeth that keeps the eye in position. Then, of course, when the holder is rotated the eye is rotated also.

forceps, held in one hand, the blades closed, are passed into the anterior chamber as far as the pupillary margin. The blades are then opened and the handle dipped slightly downward and forward, thus throwing the tip of the forceps into the iris tissue, when the blades are again closed and the seized iris withdrawn. A pair of scissors in the disengaged hand are held in readiness, the blades open, and as soon as the iris is withdrawn from the anterior chamber it is excised with one or two snips (See Fig. 25). The coloboma thus formed should be small and narrow, although in von Graefe's original operation the amount of iris excised corresponded to the length of the wound. A small coloboma, however, is sufficient for all purposes for which the iridectomy is performed, and presents a much better appearance from an æsthetic standpoint. In addition, there is less dazzling than would occur from a large coloboma, as a smaller quantity of light enters the eye.

Capsulotomy.—The assistant¹ is now relieved of the forceps which are again held by the operator, who, at the same time, passes a cystotome into the anterior chamber, held flatwise in such a manner as not to injure the iris or cornea. The instrument is carried as far as the lower margin of the pupil when it is turned with

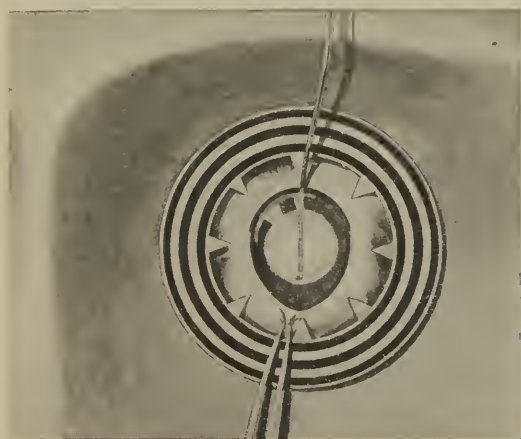


Fig. 40. Cystotome opening the capsule.

the cutting point towards the capsule (Fig. 40). A transverse opening is now

¹ It is not necessary to have an assistant in operating on animals' eyes, though it resembles more closely the actual work on the human eye.

made in the capsule by giving to the instrument a lateral movement, and then by drawing the instrument upward a perpendicular opening is made at right angles to, and beginning at the middle of, the transverse cut, and terminating in the upper periphery of the capsule. This is the opening shown in (No. 1, Fig. 35), though any of the others may be made according to the preference of the operator. The cystotome is then turned flatwise again and carefully withdrawn.

Delivery of the Lens.—In this stage the operator may, or may not, continue to hold the eye with the forceps, as he pleases. The cornea should be made moist by dropping on it a little water, after which pressure is made on the lower margin by means of the convex surface of the curette, which follows the lens upwards as it is being expelled (Fig. 41).

The curette should pass entirely across the cornea lying above its primary position, and the pressure at first should be

downward towards the interior of the eye, so as to tilt the upper edge of the lens for-



Fig. 41. Delivery of the lens.

ward, and then downwards and upwards, following the lens. The curette must not be removed from the eye until the whole depth of the cornea has been passed over, as this procedure will oftentimes bring out some of the cortical matter which has broken off from the lens in its passage. Judgment must be exercised in regard to the amount of pressure to be made as

there is always some danger of a prolapse of the vitreous, it being understood that as soon as the equator of the lens has passed the lips of the wound, the pressure is to be somewhat diminished.

Toilet of the Wound.—Any remaining cortical matter, or pieces of capsule, are now cleared from the anterior chamber or from between the lips of the wound, by gently stroking the cornea with the back of the curette, or by passing the spatula along the corneal section. If the pillars of the coloboma have prolapsed, or seem to have a tendency to prolapse, they are replaced in their proper positions by means of the spatula.

Should it be desired to practice irrigation of the anterior chamber, it may be done by using a small pipette, or a special syringe made for the purpose. It should be remembered that “in passing the liquid from the syringe into the anterior chamber, the direction of the flow should be over the wound from within outward,

and not the reverse, lest portions of the blood and cortex be driven inward." (Knapp, from de Schweinitz's "Diseases of the Eye").

Accidents Occurring during Extraction of Cataract.—There are several accidents that may occur during the performance of this operation, the chief of which are the following:

(1). The knife may be entered with its cutting edge in the wrong direction. If this has occurred the knife should be withdrawn, and if the aqueous humor escapes, as it most likely will do, a fresh eye must be substituted.

(2). The point of counter-puncture may not be diametrically opposite the point of puncture. It may be also either too far in front of, or too far behind, the corneo-scleral junction. If the operator can see that the point of the knife is not in the proper position to make the counter-puncture, and it has not already been started through the corneo-scleral tissue, it should

be slightly withdrawn and entered at the proper place. If the counter-puncture has been made before the error be discovered, the section should be completed as if it had not occurred. It is to be remembered that the conditions under which the knife is passed across the anterior chamber are somewhat deceptive, as the blade of the knife is under water, and it is only practice that will enable the student to make the counter-puncture at the proper point.

(3). The iris sometimes falls in front of the knife before the corneal section is completed, and indeed it is an exceedingly difficult thing to avoid in animals' eyes. The shape of the eye is partially the cause of this accident, while another factor is that the eye is screwed too tightly in the holder, thus making a shallow anterior chamber. In withdrawing the knife after the counter-puncture has been made, Noyes recommends to let the heel cut the temporal side of the wound as a maneuver to prevent the accident. Should it

occur, however, the section must be completed as if nothing had happened.

(4). The wound may be too small for the lens to pass through—a very unfortunate accident, and if it occurs the wound must be enlarged with a pair of blunt-pointed scissors. In making a section of the cornea it is to be remembered that the inside opening is much smaller than the outside opening and that the size of the lens to be passed through it must be given due consideration. Thus a very large, or a very small lens, might cause some slight deviation from the size of the sections described.

(5). The laceration of the capsule may not have been sufficiently extensive to permit the escape of the lens, so that when pressure is made on the lower part of the cornea it fails to present. In this case the cystotome is re-introduced and the opening enlarged.

(6). The lens may become dislocated. If the dislocation is only partial, the cor-

nea may be moistened and gently stroked with the spatula, when the lens will most likely fall into place and can be delivered in the usual manner. If the dislocation is complete and into the vitreous, the lens should be removed by means of the wire loop which is gently placed behind it, and as soon as the lens falls into the concavity of the loop it is lifted out.

(7). The vitreous sometimes escapes before, and sometimes after, the expulsion of the lens. If the accident occurs before the expulsion of the lens it is well to practice the delivery as quickly as possible with the wire loop. If it occurs after the delivery of the lens, the prolapse should be excised and the lips of the wound gently cleared. All pressure must be avoided in either case.

Extraction without Iridectomy.
Simple Extraction.—This operation differs from the combined method in the size and position of the corneal section and in omitting the iridectomy. Inasmuch as

no iridectomy is performed, the opening in the cornea must necessarily be larger to allow the escape of the lens. The section instead of being made exactly at the apparent corneo-scleral junction is usually made slightly within the clear margin of the cornea, and (in human eyes) includes about half of the periphery. In the pigs' eyes, however, on account of the shape of the cornea, the puncture and counter-puncture should be made about 4 millimetres below a tangent to the uppermost part, which makes a section sufficiently large for the delivery of the lens. Omitting the iridectomy, the subsequent procedures are the same as described in the combined method. Should the iris prolapse, an attempt is made to replace it with the spatula, and should it continue to recur, and the prolapse be a large one, the prolapsed portion must be excised, thus converting, practically, the simple into the combined method.

Operations for Secondary, or After Cataract.—The various operations per-

formed for the relief of secondary, or after cataract, depend principally upon the character of the membrane forming the cataract. If it is a thin, web-like membrane, it may be divided with a Bowman's stop needle (Fig. 42), or with a knife needle introduced in the manner described in



Fig. 42. Bowman's stop needle.

the operation of discission of cataract (page 43).

If the capsule is thick and tough, it is better to employ two needles in order to prevent dragging upon the ciliary bodies (See Fig. 29). Should the secondary cataract consist of thickened capsule, with an attached portion of the iris drawn upward, as a result of previous inflammation which followed the operation of extraction, the pupil being occluded to a greater or lesser extent, the better plan is to perform an iridotomy (See page 36).

CHAPTER V.

OPERATIONS UPON THE SCLERA.

Anterior Sclerotomy.—The operation of anterior sclerotomy is performed by some surgeons in certain cases of glaucoma, mostly of the chronic type, or in those cases in which an iridectomy had previously been performed, in spite of which an increase of the intra-ocular tension had returned.

A Graefe cataract knife (Fig. 15) and a pair of fixation forceps are required. The eye-ball being fixed, the point of the knife is passed into the anterior chamber at a point 3 millimetres below a tangent to the uppermost part of the cornea and 1 millimetre behind the apparent corneo-scleral junction, then across the anterior chamber and the counter-puncture made at a

point diametrically opposite. An upward cutting movement of the knife, as in the section for the extraction of cataract is now made, but instead of completing the section and making a corneal flap a bridge of tissue, about 3 millimetres broad at the uppermost part of the cornea, is left undivided (Fig. 43). The knife is now tilted

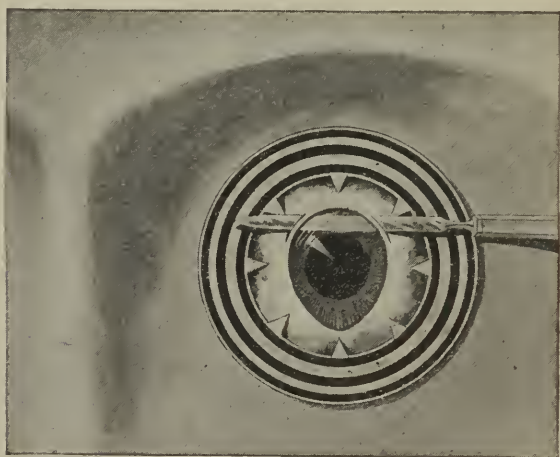


Fig. 43. Anterior sclerotomy.

slightly forward causing the lips of the wound to gape somewhat, allowing the aqueous humor to escape, if it has not

already done so, and then slowly and cautiously withdrawn. The bridge of tissue is left to guard against prolapse of the iris, but if this accident should occur, as it does sometimes, the iris must be replaced into the anterior chamber by means of a small spatula (Fig. 14). Should this not prove effectual the prolapsed portion must be cut off with scissors, thus converting the sclerotomy into an iridectomy.

Posterior Sclerotomy.—In cases of detached retina, or in cases of glaucoma, where for any reason the anterior chamber has become obliterated so that it is impossible to perform an iridectomy or an anterior sclerotomy, the operation of posterior sclerotomy is sometimes of use. The same instruments are employed as in anterior sclerotomy and the knife is passed through the posterior scleral tissue with its edge toward the cornea, as this is the direction of most of the scleral fibres. For a detached retina a puncture would

be made through the eye-ball over the detached portion and the knife turned through a quadrant of a circle to allow the subretinal fluid to escape. As soon as the latter takes place the knife is withdrawn. In glaucoma the point of selection is usually about midway between the superior and external recti muscles, 7 or 8 millimetres from the corneal margin, and the incision has to be somewhat longer than in the preceding as the vitreous is of greater consistency than the subretinal fluid. Practically the same operation is performed in some cases of extraction of a foreign body from the interior of the eye.

CHAPTER VI.

OPERATIONS UPON THE MUSCLES.

In practicing the various operations upon the muscles of the eye, the mask must be discarded and some kind of animal's head employed, in which the eyes are in their natural position. For this purpose may be used rabbits or dogs, they first being killed with chloroform. The muscles of the rabbit's eyes, however, are so much smaller than those of the human eye, and dogs are, as a rule, so difficult to obtain, that we most frequently resort to the use of the pigs' head. In preparing this the butcher must be careful not to allow it to remain in hot water too long preparatory to removing the bristles, or the cornea will not only become opaque but the bulbs shrunken, so that it will be

useless for the purpose. Some haziness of the cornea cannot be prevented, if the bristles are to be removed, but this will not matter in practicing the following operations. The head to be employed should be from a young pig preferably, from four to eight weeks old.

Complete Tenotomy.—There are several methods of performing this operation, the two principal ones being the Open Method of von Graefe and the Subconjunctival Method of Critchett.

Open Method. Method of von Graefe.
—The instruments necessary are a lid speculum (Fig. 44), conjunctival forceps (Fig. 45), (ordinary fixation forceps may be used), a pair of blunt scissors (Fig. 46) and a strabismus hook (Fig. 47).

The lids being separated by means of the speculum, the conjunctiva is seized immediately over the insertion of the muscle to be cut and incised by one or two snips of the scissors. Next, the capsule of Tenon is opened in the same manner.

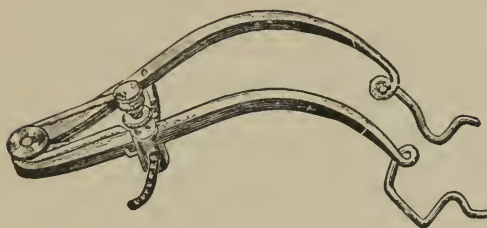


Fig. 44. Lid speculum.



Fig. 45. Conjunctival forceps.



Fig. 46. Tenotomy scissors.



Fig. 47. Strabismus hook.

Instruments Required in Tenotomy of an Ocular Muscle.

The eye-ball still being firmly held by the forceps in one hand the strabismus hook is now taken in the other and passed into the opening just made. The direction at first is downward, for a short distance, when by rotating the hook, and keeping it in contact with the sclera, it is brought behind the muscle which is then drawn forward (Fig. 48). The conjunctival forceps are now laid aside, and the hook

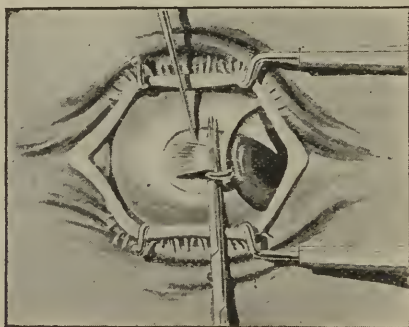


Fig. 48. Tenotomy of an ocular muscle.

being held in one hand and the scissors in the other the muscle is severed from its attachment by several snips of the latter. Care should be exercised to get all the fibers

of the muscle on the hook if possible, before cutting; but to make sure that every fiber is severed, the hook should be re-entered, and, keeping in contact with the sclera, brought forward to the attachment of the conjunctiva above and below the opening. Should any fibers be found, no matter how small, they should be divided. According to some authorities the conjunctival wound is now closed with a few vertically inserted sutures; according to others it is never closed except in those cases in which too great an effect has been obtained and it is desired to lessen it. The more conjunctiva included in the suture the more the effect of the operation will be diminished.

Sub-conjunctival Method. Method of Critchett.—The same instruments that are used in the open method are also required in this method. In performing the operation the conjunctiva and capsule of Tenon are seized over the insertion of the muscle and with one or two snips of the

scissors a very small opening is made. A strabismus hook is now entered, as in the previous operation, and passed beneath the tendon. The closed scissors are now passed through the small conjunctival opening, opened and one blade carried beneath, the other above the tendon, when, keeping close to the sclera, the muscle is divided at its insertion.

Arlt's Method.—A modification proposed by Arlt, consists in seizing the tendon with the conjunctival forceps as soon as the opening in the conjunctiva and Tenon's capsule has been made in the manner described in the open method, and dividing it at once with the scissors, a strabismus hook not being used.

Partial Tenotomy.—In some conditions, such as insufficiencies of the ocular muscles, so free a dissection of the tendon from its insertion is not required. It is then that partial, or graduated tenotomies are performed. The instruments required are those employed in the previous oper-

ations for tenotomy except that the scissors have smaller blades and are more pointed (Fig. 49). The method of procedure is as follows :

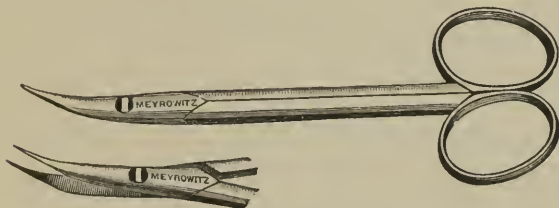


Fig. 49. Stevens' tenotomy scissors.

A small opening is made in the conjunctiva and capsule of Tenon over the centre of the insertion of the muscle which is then seized with the small forceps a short distance back of its insertion. With the small pointed scissors an opening is now made in the centre of the tendinous attachment of the muscle to the sclera. This opening is then enlarged, by cutting towards either side, until the desired amount of the tendon has been divided.

Complications.—Several complications may arise in the performance of a tenotomy on one of the ocular muscles of

the human eye, but in practicing the operation on the pig's eyes those most liable to occur are the following.

(a). *Failure to open Tenon's capsule.*—Upon attempting to introduce the strabismus hook behind the eye in order to draw forward the tendon of the muscle, it may be found impossible to do so because the capsule of Tenon has not been opened. In such a case the hook is temporarily laid aside while the opening is being made, after which it can be re-introduced and the operation completed.

(b). *Perforation of the sclera.*—This complication is exceedingly rare, but as it has happened to some very good operators it should be guarded against.

Advancement of the Ocular Muscles.—There are many methods of performing advancement of the ocular muscles, but it is not within the scope of this work to describe all of them. The following is one that usually proves entirely satisfactory.

The instruments required are the same as those used in the operation of tenotomy and, in addition, some curved needles, silk and a needle holder (Fig. 50).



Fig. 50.
Needle
holder.

The conjunctiva and Tenon's capsule are divided immediately over the insertion of the muscle, the opening being as long as the tendon is wide. That portion of the conjunctiva lying between the opening thus made and the cornea is dissected up with the scissors. A strabismus hook is now introduced beneath the tendon, care being exercised that all of the fibers are included, and brought forward to its insertion. A curved needle, armed with a silk suture, is now introduced from the upper margin and passed through the middle of the tendon and tied, the needle and thread being left in position (Fig. 51). A similar suture is passed behind the ten-

don from the lower margin and tied. The tendon is now divided with the scissors at

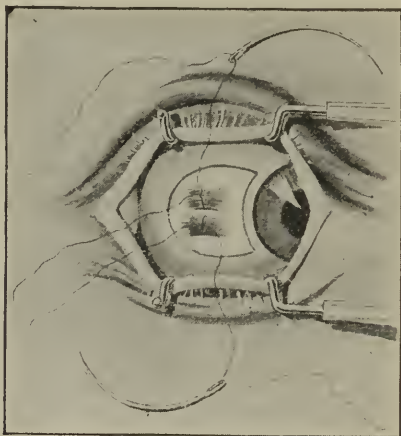


Fig. 51. Advancement of an ocular muscle. (Modified from Swanzy).

its insertion. The sutures are then passed in the direction of the muscle through the episcleral and conjunctival tissue at the margin of the cornea and tied, each with its own end. By drawing the sutures more or less tightly a large or small effect is obtained. A conjunctival suture is now introduced as the last step in the operation.

In a method proposed by Schweigger a portion of the muscle is resected before the advancement is made.

Shortening an Ocular Muscle.—This is an operation devised by Dr. Savage, of Nashville, Tenn., to take the place of advancements, and consists essentially of taking a loop in a muscle thus reducing its length. If much effect is required it is preceded by a tenotomy of the opposing muscle just as in advancement. The operation is best described in Dr. Savage's own words :

“ The first step of the operation consists of a vertical conjunctival incision one-eighth of inch behind the insertion of the tendon and a little longer than the muscle is wide. From the lower extremity of this cut a horizontal conjunctival incision is made one-fourth of an inch long, near to, and parallel with, the lower border of the muscle. The triangular flap of conjunctiva is now dissected up, and is held out of the way by an assistant. The

second step of the operation consists in making a puncture through the capsule at the lower border of the tendon and and passing a strabismus hook beneath it and then making a slight puncture of the capsule at upper border for the exit of the point of the hook. Everything is now ready for the last operative procedure, the taking of the stitch for shortening the muscle. A thread is armed with two needles slightly curved. One needle is passed through the muscle from its outer surface and is brought out beneath the lower border of the muscle; the other is passed in the same way, but it is brought out beneath the upper border of the muscle. The capsule is included in this stitch. The amount of tissue thus included in the loop need not be more than one-fourth the width of the muscle; and the distance of this loop behind the insertion of the tendon must depend on the amount of shortening desired. The muscle is held away from the globe by fixation forceps while

the needles are being passed as above indicated. The operator now taking the hook into his own hand draws it slightly back, and at the same time gently lifts the tendon from the globe. He now takes needle No. 1 and pierces the tendon from the ocular side, at its point of insertion and between the centre and its lower border, bringing it out through the conjunctiva over the insertion, then removes the needle. In a similar way needle No. 2 is passed through the tendon between its centre and upper border and is brought out through the conjunctiva over the insertion. This needle is then removed. The two ends of the one thread need not be more than one-eighth of an inch apart as they emerge from the tendon. On tying the knot in the usual way, that part of the muscle at the loop is brought in contact with the tendon at its insertion and is there confined by completing the knot. The triangular flap of conjunctiva is now allowed to fall and cover in the exposed muscle, including its 'tuck.'"

Enucleation of the Eye-ball.—There are two methods in general use for the performance of this operation, viz., Bonnet's Method and the Vienna Method.



Fig. 52.
Enucleation scissors.

Bonnet's Method.—The instruments required are a pair of small blunt scissors (Fig. 46), a pair of larger and stronger scissors for division of the optic nerve (Fig. 52), fixation forceps (Fig. 9), a strabismus hook (Fig. 47), and a speculum (Fig. 44).

The eye being held with the fixation forceps, the conjunctiva and capsule of Tenon are divided from the attachment around the cornea and freely dissected backward. Each muscle is then in turn picked up with the strabismus hook and divided at its insertion,

with the exception of the internal rectus, which is divided somewhat back of its insertion, leaving a stump that can be used for rotating the eye-ball. Seizing this stump with the fixation forceps and rota-

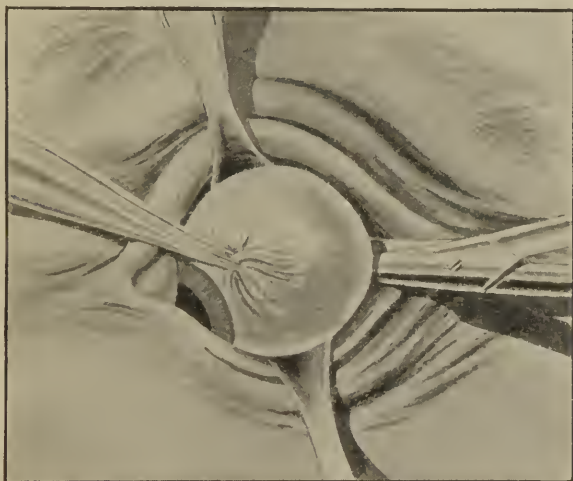


Fig. 53. Enucleation of an eye-ball. (Modified from Meyer).

ting the eye outward as far as possible, the large scissors, closed, are passed backward behind the eye-ball from the nasal side, and as soon as the optic nerve is reached they are opened and passed one

blade below, and the other above, when the nerve is divided close to the eye-ball, or deep in the orbit as may be required (Fig. 53). The globe of the eye is now dislocated forward between the lids and any remaining attachments divided.

The Vienna Method.—The only instruments required in this method are a strong pair of scissors and the fixation forceps. The tendon of the internal rectus muscle is seized with the conjunctiva and capsule and held during the entire operation. With the strong scissors it is divided back of the forceps. Then the scissors are passed around the entire eye-ball, one blade beneath the conjunctiva and muscles, the other on the outside, when by numerous cuts the muscles and conjunctiva are separated from the globe at the same time. The latter now being rotated outward the optic nerve is divided as in the preceding operation.

Accidents.—The only accident that is liable to occur is perforation of the sclera,

and this may, and should be, avoided by using only blunt scissors.

Evisceration.—Two methods of evisceration are employed at the present time, viz., the one suggested by Graefe, the other suggested by Mr. Mules.

Graefe's Method.—The instruments employed are a Graefe cataract knife (Fig. 15), fixation forceps (Fig. 9), a pair of curved scissors (Fig. 46), a scoop (Fig. 54), a speculum (Fig. 44), needles, needle



Fig. 54. Evisceration scoop.

holder (Fig. 50) and silk. The Graefe cataract knife is entered at the corneo-scleral junction, passed directly across the anterior chamber, the counter-puncture being opposite the point of entrance, and a flap made separating the upper half of the cornea from the sclera. The remaining half of the cornea is then detached with scissors. With the scoop the contents of

the globe are then thoroughly evacuated, care being exercised to remove every portion of the choroid and ciliary bodies. The sclera and conjunctiva are then sutured.

Mules' Operation.—To provide a stump for an artificial eye even better than the one obtained from the preceding operation, the following measures have been devised. The conjunctiva is first detached from the corneal margin with a pair of curved scissors. The cornea is then removed and the contents of the globe evacuated, precisely as in the preceding operation. By making a snip with the scissors above and below, the opening in the globe is enlarged vertically. One of Mr. Mules' glass globes (Fig. 55) are now introduced by means of an instrument devised for the purpose (Fig. 56), and the sclera sutured from side to side. The



Fig. 55. Mules' vitreous spheres.

overlying conjunctiva is then sutured from above downward, at right angles to the line of scleral sutures.



Fig. 56. Artificial vitreous introducer.

Resection of the Optic Nerve.—An opening is made in the conjunctiva slightly back of that portion lying over the insertion of internal rectus muscle. The conjunctiva is then dissected well backward and the muscle exposed as completely as possible. Sutures are now passed through the muscle back of the tendon in order to secure it and the muscle is then divided about 5 or 6 millimetres from its tendinous insertion. With a retractor the tissues are now pulled aside, and a hook is passed beneath the optic nerve which is drawn forward and divided as far back as possible with the strong curved scissors. A piece of the nerve is next excised from the globe of the eye

when the muscle is re-attached by means of the sutures, and the conjunctival opening is closed.

Exenteration of the Orbit.—The first step is to divide the external commissure to a point corresponding to the temporal margin of the orbit. The tissues are then dissected from the lids as far as the orbital margin, when both the periosteum and tissues are together dissected backward to the optic foramen. This being the only point of attachment left they are divided and any remaining shreds removed, the bone being completely denuded.

INDEX.

- A**BSORPTION of the lens.43
 Accidents during ex-
 traction65
 Advancement of the ocular
 muscles..82
 After cataract,operationsfor,69
 Alcohol lamp.....20
 Ambidextrous 55
 Animal10
 Anterior chamber 19, 24, 25, 61
 Anterior chamber, irrigation
 of.....64
 Anterior chamber, paracen-
 tesis of.....21, 25
 Anterior sclerotomy.....71, 72
 Application of cautery to cor-
 nea, instruments required.19
 Aqueous humor.....23, 33
 Artificial pupil.....36
 Artificial vitreous introducer93
 Assistant.....59, 61
- B**EEER'S KNIFE.....51
 Blood.....65
 Bowman's stop needle70
 Bowman's suction syringe...45
 Bridge.....72
 Bristles..76
 Broad peripheral iridectomy.30
 Butcher.....75
- C**APSULE FORCEPS..54, 56
 Capsule, methods of
 opening..... 53
 Capsule of Tenon.....77
 Capsule of the lens, opera-
 tions upon.42
 Capsule, laceration of.....67
 Capsulotomy60
 Cataract, dicission of.....43
 Cataract, extraction of.....46
 Cataract, hard, operations
 for47
 Cataracts, immature..42
 Cataracts, ripening imma-
 ture, Bettinan's method....42
 Cataracts, ripening imma-
 ture, Förster's method.....42
 Cataract, simple linear ex-
 traction of.....46
 Cataract, soft, methods of
 operating upon.....43
 Cataract, suction operation..45
 Cataractous lens.....29
 Cautery, actual19
 Cautery, application of.....19
 Cautery, galvanic.....19
 Cautery-probe.....20
 Chloroform...75
 Ciliary bodies.....70
 Clip, eye.....12
 Coloboma60
 Coloboma, method of mak-
 ing large in iridectomy...35
 Coloboma, method of mak-
 ing small in iridectomy...35
 Coloboma, pillars of.... 35, 64
 Coloboma, position of.....28
 Coloboma, size of..... ..27
 Combined extraction, meth-
 od of operating in.....55
 Complete tenotomy.....75
 Complications in muscle op-
 erations.....81
 Conjunctiva.....16
 Conjunctival flap.....49, 50, 58
 Cornea.....10, 25, 26
 Cornea, epithelium of...19, 20
 Cornea, infection of.....19
 Cornea, operations upon.....18
 Cornea, sloughing ulcer of..24

- Cornea, tattooing the.....25
 Cornea, tattooing, instruments required in.....25
 Cornea, ulcer of.....20, 22, 24
 Corneal section in combined extraction.....56
 Corneal section in iridectomy.....32
 Corneal section, position of.....30
 Cortical matter.....63, 64
 Cosmetic.....25
 Counter-puncture.....58
 Crystalline lens.....19
 Crystalline lens, operations upon.....42
 Curette.....62
 Cystotome.....61
 Cystotome and curette.....46
 Cystotome opening the capsule.....61
- D**AZZLING.....60
 Delivery of the lens.....62, 63
 Detached retina.....73
 Details, attention to.....16
 Dicision needle.....43
 Dicision of cataract.....43, 70
 Dislocation of the lens.....54, 67
 Dissolution of the lens.....43
 Dogs.....75
- E**NUCLEATION of an eye-ball.....88
 Enucleation of an eye-ball, Bonnet's method.....88
 Enucleation of an eye-ball, Vienna method.....90
 Episcleral tissue.....84
 Equator of the lens.....64
 Evisceration of an eye-ball.....91
 Evisceration scoop.....91
 Excision of iris.....33
 Exenteration of the orbit.....94
 External commissure.....94
 Extraction of cataract.....46
 Extraction of cataract, simple linear.....46
 Extraction without capsulotomy.....54
 Extraction without iridectomy.....68
 Eye, adjustment of in mask.....15
 Eye, bullock's.....9, 10
 Eye, human.....17
 Eye, pig's.....9
 Eye, shape of.....66
 Eye, sheep's.....9
 Eye speculum.....77
 Eye-ball, enucleation of.....88
 Eye-ball, evisceration of.....91
 Eyes, choice of.....9
 Eyes, preservation of.....10
- F**ACE, HUMAN.....12
 Face, phantom.....15
 Forceps, fixation 17, 18, 21, 24, 26
 Forceps, iris.....25
 Forceps, iris, position of in iridectomy.....34
 Foreign body, removal of.....18
 Formaldehyde.....12
- G**LAUCOMA.....22, 71
 Graefe knife.....29, 30
- H**YPOPYON.....24
- I**MMATURE CATARACTS.....42
 Immature cataracts, ripening of.....42
 Inflammation.....70
 Ink, India.....26
 Instruments required 18, 21, 24, 30, 31
 Instruments required in combined extraction.....55
 Instruments required in irido-dialysis.....40
 Instruments required in tenotomy.....76

Instruments required for iridectomy..... 30, 31
 Instruments required for paracentesis of anterior chamber.....21
 Instruments required for removal of a foreign body from cornea.....18
 Instruments required for Saemisch's section.....23
 Instruments required for tattooing the cornea.....25
 Instruments required for the application of cautery to cornea19
 Insufficiencies of the ocular muscles.....80
 Intra-ocular tension.....27
 Intra-ocular tension, iridectomy for.....28
 Iridavulsion40
 Iridectomy 27, 59
 Iridectomy, broad peripheral 27, 30
 Iridectomy, corneal section in.....32
 Iridectomy for optical purposes.....28
 Iridectomy for relief of intra-ocular tension.....28
 Iridectomy, method of performing.....32
 Iridectomy, narrow..... 30
 Iridectomy, position of keratome in.....33
 Iridectomy preceding cataract extraction.....28
 Iridectomy, stages of.....32
 Iridectomy, small.....28
 Iridectomy, varieties of..... 27
 Irido-dialysis39
 Irido-dialysis, instruments required in.....40
 Iridotomy.....36, 70
 Iridotomy, external.....38
 Iridotomy, internal.....37
 Iridotomy, loss of vitreous in.....38

Iridotomy, object of.....36
 Iris, excision of.....33
 Iris forceps, position of in iridectomy34
 Iris, foreign bodies in.....27
 Iris, operations upon27
 Iris, prolapse of23, 39
 Iris scissors, position of in iridectomy.....34
 Iritis, recurrent.....27
 Irrigation of anterior chamber.....64

JUDGMENT.....63

KERATOME....19, 21, 29, 30
 Knife16
 Knife, Graefe cataract.....24
 Knife needle 43

LACERATION of the capsule.....67
 Lance needle.....43
 Lens, absorption of.....43
 Lens, cataractous.....29
 Lens, delivery of.....62, 63
 Lens, dislocation of...43, 54, 67
 Lens, equator of.....64
 Lens, massage of.....42
 Leucoma25
 Light.....60
 Loss of vitreous.....54
 Loss of vitreous in iridotomy 38
 Lymph channels.....41

MARGIN of the pupil.....61
 Mask.....9, 12, 29
 Mask, home-made.....13
 Mask, position of.....54
 Mask, Vienna.....12
 Massage of the lens.....42
 Membrane.....70
 Method of operating in iridectomy.....32

Method of operating in combined extraction.....55
 Methods of opening the capsule.....53
 Methods of operating upon soft cataract.....43
 Mules' operation.....92
 Mules' vitreous spheres.....92
 Muscle.....16
 Muscles, advancement of.....82
 Muscles, insufficiencies of ..80
 Muscles, operations upon....75
 Muscles, shortening of.....85

NARROW iridectomy.....30
 Needle dissection.....43
 Needle holder83
 Needle, paracentesis.....21
 Needle for tattooing.....25
 Nose12

OPERATING CHAIR.....55
 Operations for after-cataract.....69
 Operations for hard cataract 47
 Operations for secondary cataract.....69
 Operations upon the cornea 18
 Operations upon the crystalline lens.....42
 Operations upon the iris.....27
 Operations upon the lens capsule.....42
 Operations upon the muscles.....75
 Operations upon the sclera 71
 Operator, position of.....29, 55
 Optic foramen.....94
 Optic nerve, resection of.....93
 Optical purposes, iridectomy for.....28
 Optical purposes, operations for.....29
 Orbit.....12
 Orbit, exenteration of.....94

PARACENTESIS of anterior chamber, instruments required in.....21
 Partial tenotomy.....80
 Paste.....26
 Patient, human13
 Peripheral linear section....48
 Pigments.....26
 Pig's head.....75
 Pillars of coloboma.....35, 64
 Position of coloboma.....28
 Position of corneal section...30
 Position of iris forceps in iridectomy.....34
 Position of iris scissors in iridectomy.....34
 Position of keratome in iridectomy.....33
 Position of the mask54
 Position of the operator..29, 55
 Posterior sclerotomy.....73
 Practicing sections, method of.....51
 Preliminary iridectomy.....28
 Pressure.....68
 Probe25
 Prolapse of iris.....39
 Prolapse of iris in simple extraction69
 Prolapse of vitreous.....64, 68
 Pupil.....25, 26
 Pupil, artificial.....36
 Pupil, restoration of.....29
 Pupillary margin.....60
 Pus.....25

RABBITS.....75
 Resection of optic nerve 93
 Ripening immature cataracts.....42
 Ripening immature cataracts, Bettman's method....42
 Ripening immature cataracts, Förster's method....42
 Retina, detached.....73

SAEMISCH'S SECTION

23	
Saemisch's section, instruments required in.....	23
Scissors	60
Scissors, iris, position of in iridectomy.....	34
Sclera, operations upon.....	71
Sclerotomy, anterior.....	71, 72
Sclerotomy, posterior	73
Secondary cataract, operations for.....	69
Section in combined extraction.....	49
Section in simple extraction	50
Section of the cornea in combined extraction.....	56
Section, peripheral linear....	48
Section, position of corneal	30
Section, Saemisch's, instruments required in.....	23
Section, varieties of	48
Section, method of practicing	51
Shape of the eye.....	66
Shortening an ocular muscle.....	85
Simple extraction	68
Simple extraction, prolapse of iris in	69
Simple extraction, section in.....	50
Simple linear extraction of cataract.....	46
Spatula	23
Spud.....	18
Strabismus hook.....	77
Stages of iridectomy.	32
Staphalomatata.....	27
Student.....	66

Suction operation of cataract

45	
Subretinal fluid.....	73
Synechia.....	29
Syringe, Bowman's suction	45
Syringe, Teale's suction.....	45

TANGENT.....

58, 69	
Tattooing cornea, instruments required in....	25
Teale's suction syringe.....	45
Temple	12
Tenon's capsule.....	77
Tenotomy, Arlt's method....	80
Tenotomy, Critchett's method.....	79
Tenotomy, complete.....	76
Tenotomy, von Graefe's method.....	76
Tenotomy, partial	80
Tension, intra-ocular 22, 23, 27	
Three millimetre flap	49
Toilet of the wound.....	35, 64

UNIVERSAL HANDLE

20	
VARIETIES of section....	48
Vision, improvement of	27
Vitreous, loss of... ..	54
Vitreous, prolapse of.....	64, 68

62, 66	
Wire loop.....	57
Wound.....	25
Wound, toilet of,	64
Wound, toilet of in iridectomy.....	35

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